

On the identity of the grey scale *Diaspidiotus africanus* Marlatt and some related species from southern Africa (Homoptera: Diaspididae)

by

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In this study the identity of *Diaspidiotus africanus* is discussed, and the following species are found to be junior synonyms of it: *Aspidiotus pectinatus* Lindinger, *Aspidiotus mashonae* Hall, *Aspidiotus (Diaspidiotus) mazoeensis* Hall, and *Clavaspis betrokensis* Mamet. *Clavaspis perplexus* and *Diaspidiotus yomae*, both from South Africa, are described as new, while *Diaspidiotus ancylus* (Putnam) and *D. osborni* (Newell & Cockerell) are recorded from this country for the first time, and redescribed. A redescription of *Dynaspidiotus regius* Brain is also presented.

For many years the grey scale, a pest in the deciduous fruit growing areas of the Cape, has presented difficulties with identification because of morphological variation encountered and because Marlatt (1908) described it from material representing more than one species. This discrepancy in Marlatt's description was noticed by Lindinger (1909) and Brain (1918) but not corrected.

The true generic position of the grey scale is not discussed since there are a number of large cosmopolitan genera involved and the author has no access to the many species. Takagi (1969) has recently placed *Diaspidiotus* Berlese, 1896 and *Quadraspidiotus* MacGillivray, 1921 as subjective synonyms of *Hemiberlesia* Cockerell, 1897 primarily because of Stannard's (1965) findings on the variation in the size of the second lobes of *Aspidiotus ancylus* Putnam, until recently considered by most authors the type species of *Diaspidiotus* (auctorum); this is rejected at this stage.

De Lotto (1963) indicated the correct author and type species of this genus, but this led to great confusion since the type species was shown by him to be *Aspidiotus (Diaspidiotus) patavinus*, a junior synonym of *A. pyri* Lichtenstein placed by Balachowsky (1950) and others in *Quadraspidiotus*. *Diaspidiotus* Leonardi, 1898 (*nec* Berlese, 1896) with *ancylus* as type species is of course a junior homonym of Berlese's genus, and if a genus is justified for *ancylus* and its congeners it should be given another name, while *Quadraspidiotus* would then be a subjective synonym of *Diaspidiotus* Berlese.

In this paper the generic classification of Ferris (1938, 1942), Balachowsky (1951, 1956), and others is followed because of the confusion at present existing regarding the concepts of the above genera. A comprehensive revision on a world basis is much needed.

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References not given in this paper may be found in Borchsenius' (1966) catalogue of the armoured scale insects. Where long series of specimens have been examined the collecting date and collector's name have been omitted for the sake of brevity.

Holotypes and paratypes of the new species described below are in the National Collection of Insects, Plant Protection Research Institute, Pretoria; a paratype of each has also been deposited in the United States National Museum, Washington, and the British Museum (Natural History), London.

***Clavaspis perplexa* spec. nov., fig. 1**

Scale of adult female roughly circular, about 1.3 mm in diameter, greyish-brown in colour. Male puparium oval, about 0.8 mm long, grey with a whitish apex.

Adult female turbinate, 0.5–1.0 mm long when mounted. Prosoma slightly sclerotized at maturity. Antennal tubercles with a single hair. Marginal thoracic tubercle poorly developed. Dorsosubmarginal microducts present on the cephalic to third abdominal segments but not very numerous and sometimes missing on one or more of these segments; two larger marginal ducts occur on each of the prepygidial abdominal segments. Median lobes squat, broader than long, with a single notch on the outer margins; second lobes represented by a slight elevation of the pygidial margin; third lobes obsolete. Two paraphyses arise from between the median lobes and are variously developed but never extend further forward than the submarginal setae on segment (viii); a pair from between the median and obsolete second lobes of which the mesal one is long and clavate; a pair from near the seta indicating the position of segment (vi). A small apically bifurcate plate occurs between median lobes, two between median and obsolete second lobes and two exterior to the latter. Pygidial macroducts rather few, distributed as follows: one marginally between median lobes, two between median and second lobes, an intermittent oblique series of four to seven ducts arises from the outer pair of paraphyses and a series of three to six ducts from the margin anterior to the seta indicating the position of segment (vi). Perivulvar pores absent. Anterior margin of anus 43–56 μ from apex of median lobes.

MATERIAL EXAMINED. SOUTH AFRICA: Transvaal, Chuniespoort 8.xii.1965 on *Euphorbia* sp. (Euphorbiaceae), H. K. Munro. Described from adult ♀-holotype (H.C. 2022/12) and 14 adult ♀-paratypes.

NOTES. The squat median lobes distinguish this species from all others currently placed in *Clavaspis*. The relative length of the mesal paraphysis of the first poriferous furrow, position of anal opening and absence of perivulvar pores are also diagnostic.

***Diaspidiotus africanus* Marlatt, fig. 2**

- Aspidiotus (Diaspidiotus) africanus** Marlatt, 1908, *Tech. Ser. Bur. Ent. U. S.* 16:15
Aspidiotus pectinatus Lindinger, 1909:43 **syn. nov.**
Aspidiotus (Diaspidiotus) africanus Marlatt; Brain, 1918:125 (misidentification)
Aspidiotus mashonae Hall, 1929:347 **syn. nov., partim.**
Aspidiotus (Diaspidiotus) mazoeensis Hall, 1929:351 **syn. nov.**
Clavaspis africanus (Marlatt); Balachowsky, 1956:92
Clavaspis mazoeensis (Hall); Balachowsky, 1956:96
Di-clavaspis mashonae (Hall); Balachowsky, 1956:102
Clavaspis betrokensis Mamet, 1959:468 **syn. nov.**

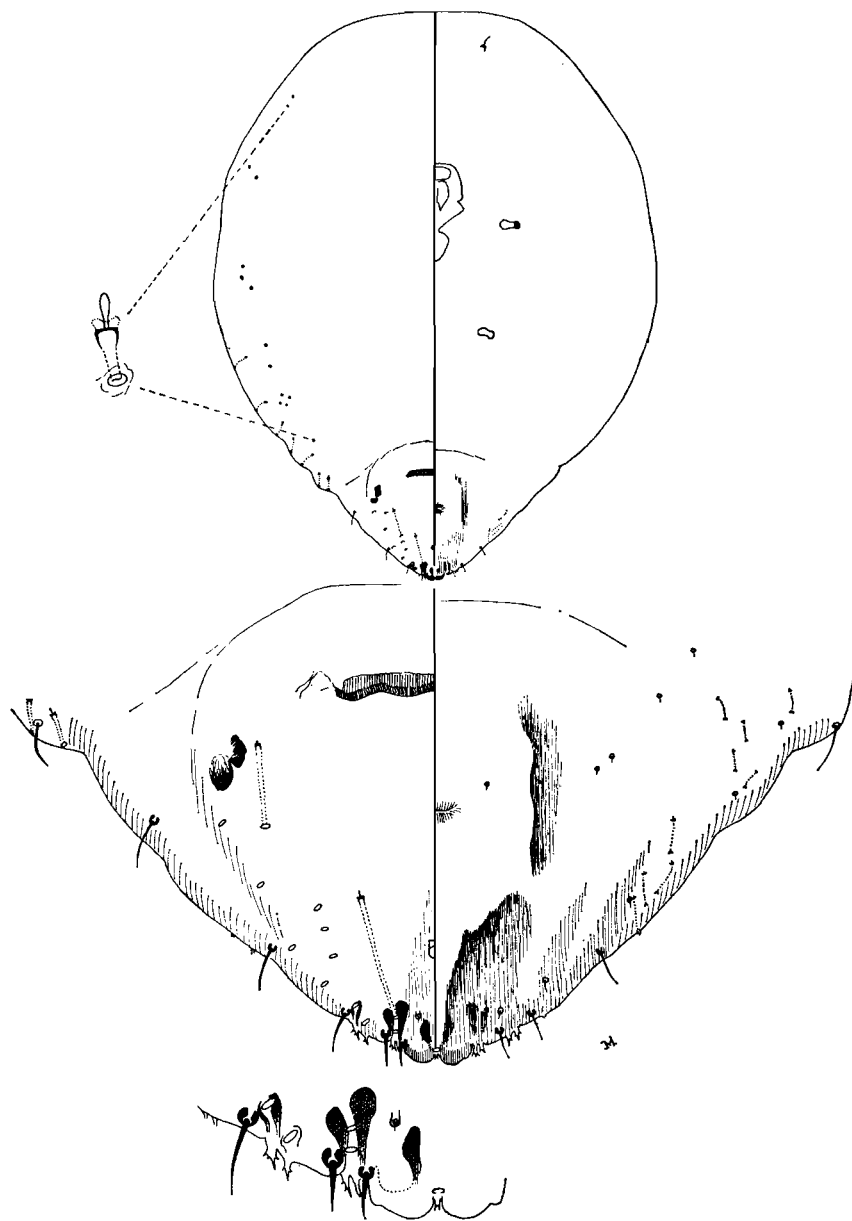


Fig. 1. *Clavaspis perplexa* spec. nov.

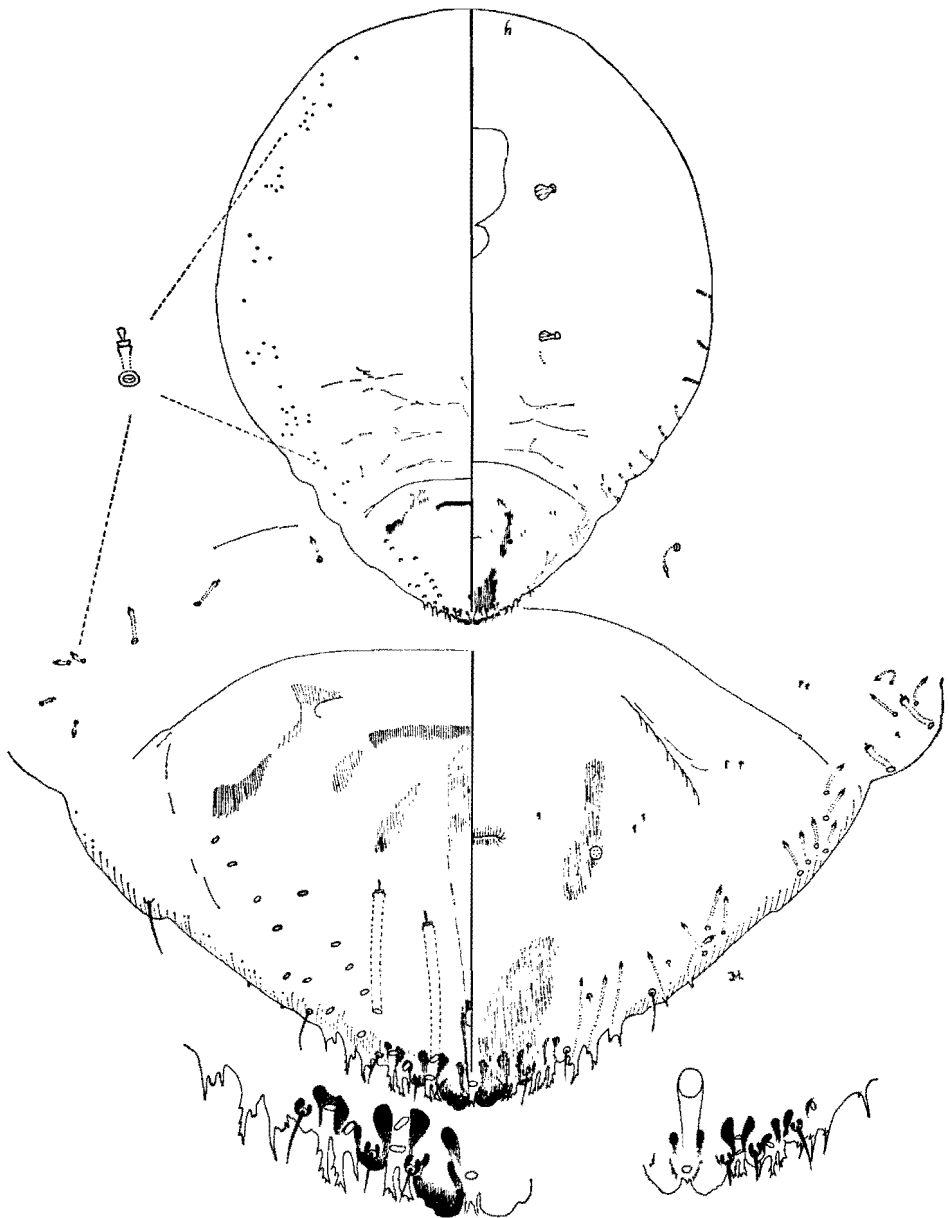


Fig. 2. *Diaspidiotus africanus* Marlatt.

Adult female turbinate, about 1 mm long when mounted. Prosoma membranous except for the marginal and submarginal area which may be slightly sclerotized. Antennal tubercles with a single bristle. Marginal thoracic tubercle inconspicuous when present. Submarginal groups of dorsal microducts present on cephalic to third abdominal segments, and a pair of larger marginal ducts on each of the metathoracic to third abdominal segments. Median lobes with outer margins converging and usually with a single subapical notch, mesal margins often also with a single subapical notch; second lobes normally rudimentary, sometimes well developed (fig. 3B) but never sclerotized to such an extent that they retain a yellow colour after having been stained in acid fuchsin; third lobes absent or only present as a slight, more or less pointed projection of the margin. Paraphyses present as follows: a pair arising from the mesal angles of the median lobes though these may be almost absent in young adult females; a pair bounding the first poriferous furrow between median and second lobes and a pair bounding the second poriferous furrow mesad to the dorsosubmarginal setae of segment (vi). Pygidial plates variable in shape and occurring as follows: a pair, sometimes rudimentary, between median lobes, a pair always present between median and second lobes, two or three between second and obsolete third lobes, and three laterad to dorsomarginal setae of segment (vi). These plates on segment (vi) may be well developed and variously fringed (fig. 4A to F), more or less spinose (fig. 4N), or rudimentary (fig. 4G and H); in extreme variants they may be almost absent. Total number of dorsopygidial macroducts very variable: in material from *Gleditsia* this varies from 23 to 56 (fig. 5A), on pear from 23 to 52 (fig. 5B). This appears to be the normal variation for true *africanus*. Usually only two ducts present between median and second lobes: of the material listed below 1·6% had one duct and 2·1% three ducts in this position but in each case only on one side of the pygidium. The degree of "roundness" of the pygidium as expressed by the "pygidial angle" (fig. 7) also varies considerably as indicated in figures 5A and 5B, the average being about 135 degrees. Perivulvar pores entirely absent or present in four groups with two to four ducts in each as in material from Babanango on *Clerodendron*. Anal opening at about apical one-quarter to one-fifth of pygidium; diameter smaller than width of median lobes.

MATERIAL EXAMINED. RHODESIA: Mazoe, on *Combretum* sp. (Combretaceae) (Cotype *mashonae*); undet. host, (Cotypes *mazoeensis*). SOUTH AFRICA: Transvaal: Halfway House, on *Ehretia rigida* (Boraginaceae), (H.C. 2806, 2283); Potchefstroom, on *Gleditsia triacanthos* (Leguminosae), (H.C. 2933); Pretoria, on *Acacia* sp. (Leguminosae), (H.C. 2141), *Combretum erythrophyllum* (Combretaceae), (H.C. 2071), *G. triacanthos*, (H.C. 2327), *Olea europaea* (oleaceae), (H.C. 1509), *Pyrus communis* (Rosaceae), (H.C. 1909); Vereeniging, on *G. triacanthos*, (H.C. 2890). Cape Province: Cape Town, on *Laurus* (Lauraceae), (H.C. 2151) and *Pyrus communis*, (H.C. 1690); Ceres, on *P. communis*, (H.C. 1254 & 2058), *Pyrus malus*, (H.C. 2319), *Prunus communis* (Rosaceae), (H.C. 2287), and *Cydonia* (Rosaceae), (H.C. 2288); Franschhoek, on *Prunus domestica*, (H.C. 2111); Herold, on *Pyrus communis*, (H.C. 2190, 2192, 2209, 2261, 2263), on *Prunus communis*, (H.C. 2191, 2259); Joubertina, on *Grewia occidentalis* (Tiliaceae), (H.C. 2213), on *Prunus* sp., (H.C. 2214), on *Psoralea* (Leguminosae), (H.C. 2211, 2215); Kimberley, on *Prunus communis*, (H.C. 1681); Komgha, on *Pyrus communis*, (H.C. 1685); Orchard Siding, on *Pyrus communis*, (H.C. 1693); Paarl, on *Prunus communis*, (H.C. 2262, 2834, 2839), on *Prunus domestica*, (H.C. 1257, 2840, 3028), on *Ficus* (Moraceae), (H.C. 1689), on undet. host, (H.C. 2285); Prince Albert, on undet. host, (H.C. 1714); Prince Alfred Hamlet, on *Prunus communis* (H.C. 2322), on *Pr. domestica*, (H.C. 2317),

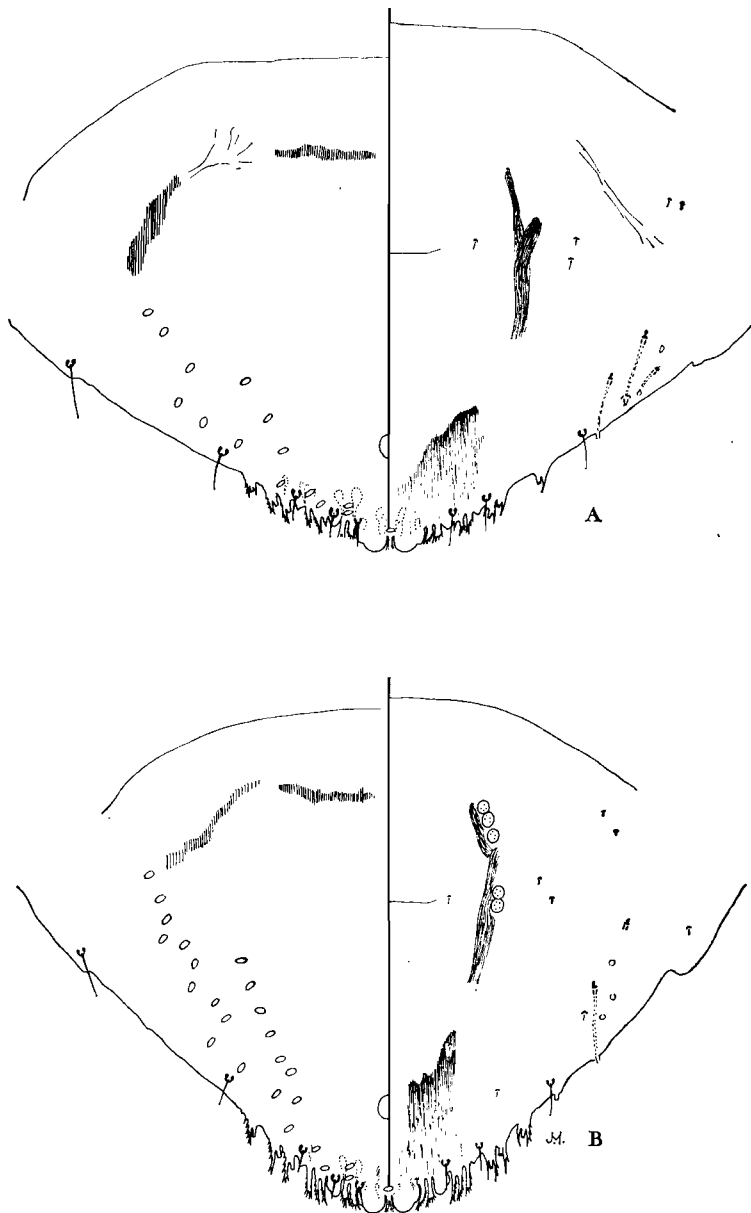


Fig. 3. *Diaspidiotus africanus* Marlatt. Host plant induced variation of pygidial characters. A. Pygidium from parent stock ex *Gleditsia triacanthos*. B. Pygidium of adult female bred on *Citrullus vulgaris* from crawlers transferred to it from *Gleditsia*.

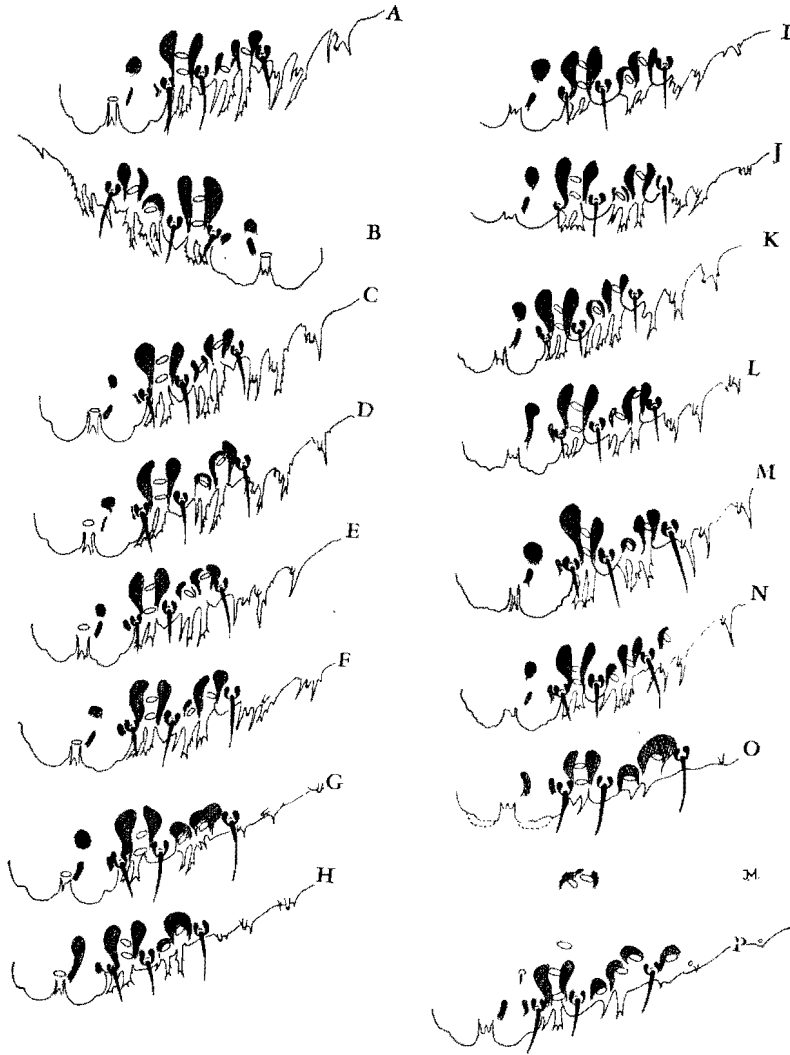


Fig. 4. *Diaspidiotus africanus* Marlatt. Variation in pygidial fringe of material from A, pear at Herold (H.C. 2190/4); B, pear at Cape Town (H.C. 1690/1); C-E, pear at Uniondale (H.C. 1880/4, H.C. 1880/2, 1898/1); F, pear at Pretoria (H.C. 1909/2); G-H, pear at Ceres (H.C. 2127/1, 2058/2); I-L, *Gleditsia triacanthos* at Bloemfontein (H.C. 2309/21, 2309/22, 2087/3, 2309/23); M, type material of *D. mazoensis* Hall (H.C. 2801); N, type material of *D. africanus* from *G. triacanthos* at Bloemfontein received from Washington (Lot no. 14121); O, *Diaspidiotus* "pituranthi group" from *Robinia pseudacacia* at Bloemfontein (H.C. 1692/2); P, *Diaspidiotus pituranthi* (Williams), paratype from *Pituranthos* at Twee Rivieren (H.C. 1536/1).

on *Pr. persicus*, (H.C. 2265); Speelmanskraal, on *Pyrus communis*, (H.C. 1880); Stella, on *Acacia karroo* (Leguminosae), (H.C. 3242); Tosca, on *A. nigrescens*, (H.C. 2623); Uniondale, on *P. communis* (H.C. 1898, 2260), on *Pr. communis* (H.C. 2188); Worcester, on *Nerium oleander* (Apocynaceae), (C.K.B. 191B). Natal: Babanango, on *Clerodendron glabrum* (Verbenaceae), (H.C. 1176). Orange Free State: Bloemfontein, on *Gleditsia triacanthos*, (H.C. 2087, 2309, 3782), on *Cydonia*, (H.C. 1979), on *Ficus*, (H.C. 503), on *Ligustrum japonicum* (Oleaceae), (H.C. 1934); Brandfort, on *Ficus caricus*, (H.C. 2305). SOUTH WEST AFRICA: no locality given, on Date Palm, (H.C. 2073); Keetmanshoop, on *Acacia giraffae* (Leguminosae), (H.C. 3761).

The above lots represent 352 specimens in which are included four poorly mounted specimens from the type material* of *africanus* (H.C. 3782).

Notes

In Marlatt's description of *africanus* (1908) he says "plates minute inconspicuous", which is contradicted by the photograph accompanying the description. Furthermore, he says on the next page "Specimens on *Gleditsia triacanthos* are followed in description except as to note on paragenitals". Now, of the 72 specimens from *Gleditsia triacanthos* examined by the present writer it cannot be said of any one that the plates are "minute" though it is true of some of the other material Marlatt had before him. It is probable therefore that Marlatt made a mistake in describing the plates of the *Gleditsia* material as minute (see figs. 4I-L).

An examination of some of Marlatt's type material reveals that there are two species involved, both of which he called *africanus*: one from *Gleditsia* from Bloemfontein which was chosen as the type host and locality, and another which is represented by the material from Bloemfontein on pepper (*Schinus molle*) and *Robinia pseudacacia* in which the plates are very small and inconspicuous. (fig. 4O & fig. 6).

Lindinger (1909) apparently noticed this discrepancy between the description and figure and described *Aspidiotus pectinatus* as a new species from pear in the Cape; he compared material of his *pectinatus* with a specimen determined by Marlatt as *africanus*. The specimen Marlatt identified for him must have been like the material mentioned above from pepper and *Robinia* which would therefore have justified Lindinger's description of *pectinatus*; unfortunately the material of *africanus* with which Lindinger compared his *pectinatus* was apparently misidentified by Marlatt.

Efforts to locate Lindinger's types or type material of his species were in vain, and Dr. Williams (*in litt.*) of the Commonwealth Institute of Entomology informed the writer that his collection was destroyed during the last war.

VARIATION. The variation which may occur in the pygidial fringe of specimens from *Gleditsia* from various localities is represented in figs. 4I-L & N and that in material from pear in figs. 4A-H. It will be seen that there is no ground for separating *pectinatus* from *africanus* on this character.

There seems to be an almost continuous variation in the size of the plates, from *africanus* specimens with long plates through *pituranthi* with shorter plates to specimens with plates as reduced as those in fig. 6.

Other characters which have led to confusion are the roundness of the pygidium, the number of dorsopygidial macroducts on segments (v) to (viii), and the degree of

* By this term is meant material of the original lot(s) remaining after the holotype and/or paratypes have been mounted from it.

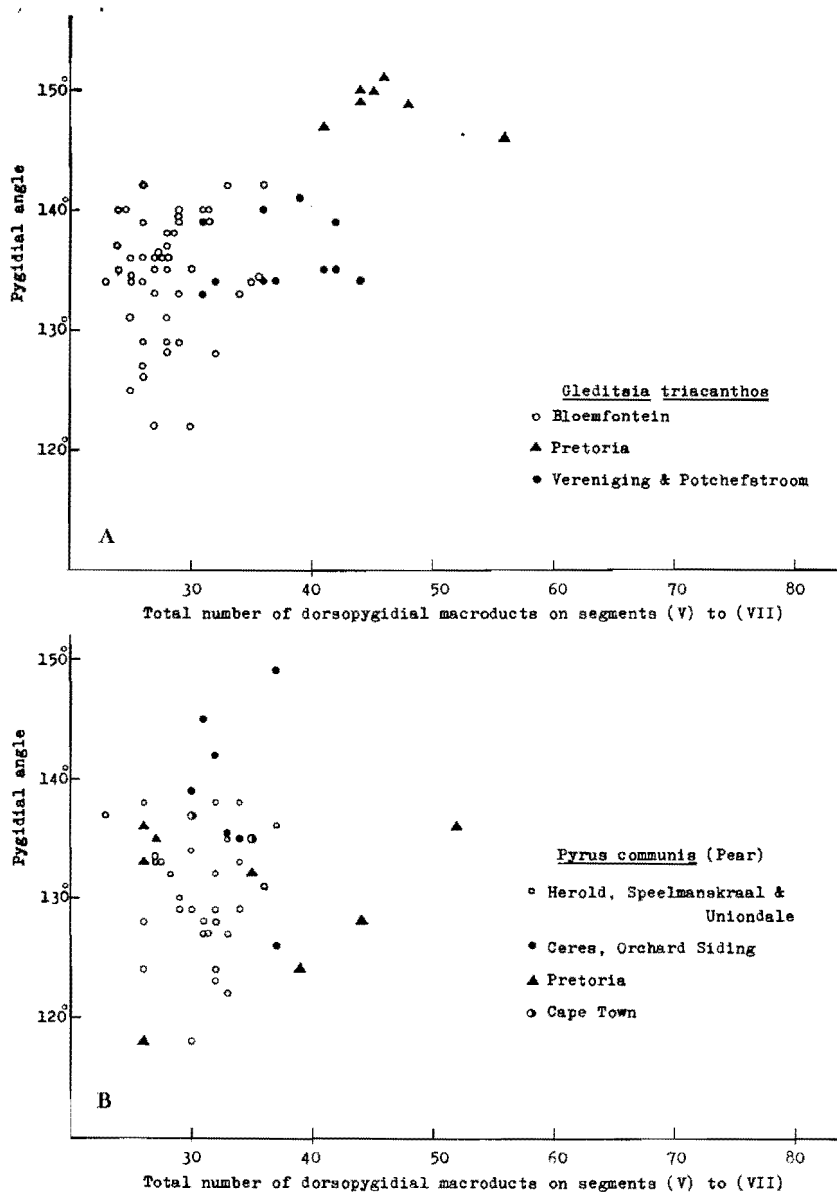


Fig. 5. *Diaspidiotus africanus* Marlatt. Variation of the pygidial angle with the number of dorsopygidial macroducts in specimens from various localities on A, *Gleditsia triacanthos* and B, *Pyrus communis*.

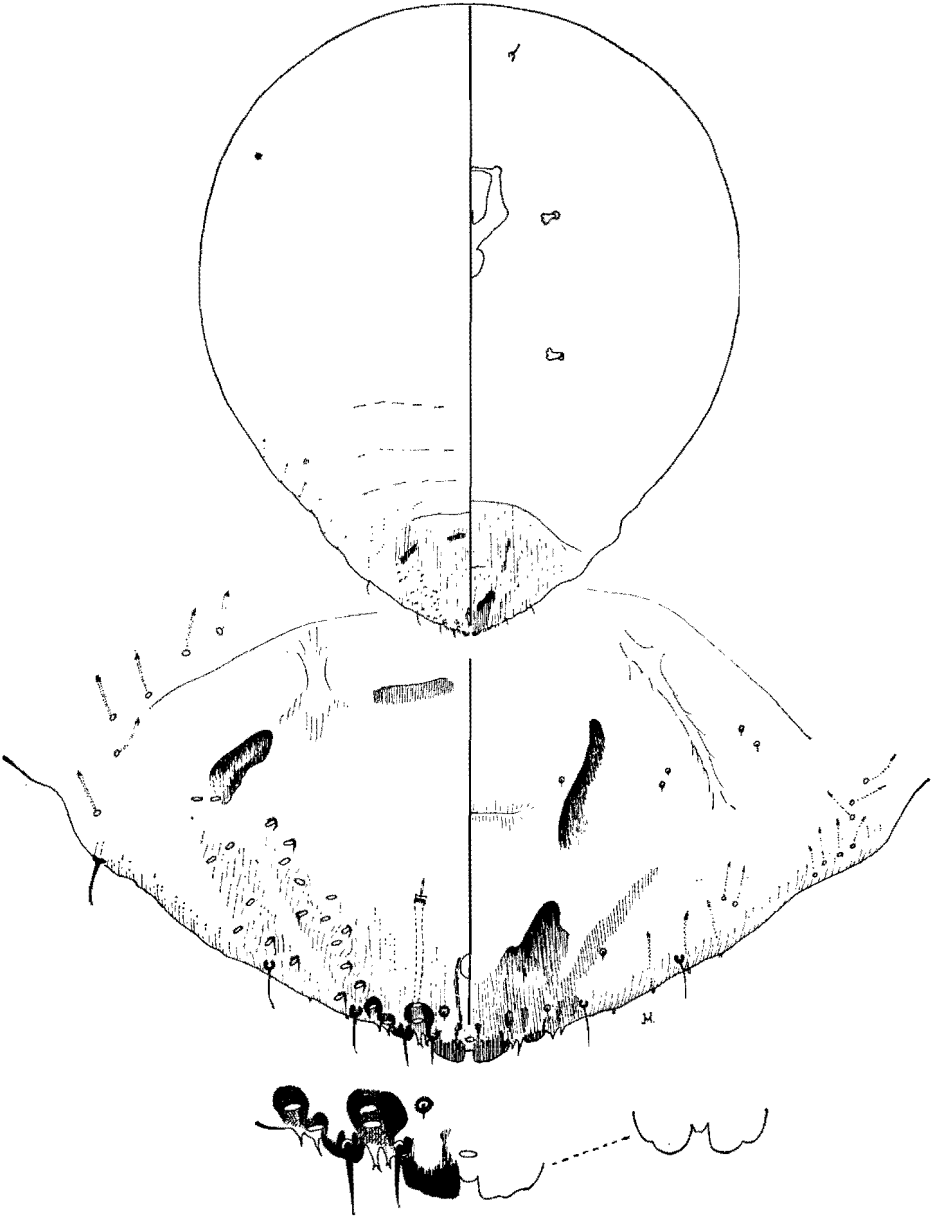


Fig. 6. *Diaspidiotus* "pituranthi group" from *Robinia pseudacacia* from Bloemfontein.

development of the second lobes. It was therefore advisable to measure the "pygidial angle" and plot it on the Y-axis with the number of dorsopygidial macroducts on the X-axis to demonstrate graphically the variation which may be found in these two characters; some preliminary breeding experiments have demonstrated the variation which may be found in the degree of development of the second lobes.

The pygidial angle was measured as follows. A projection of the pygidium was cast onto a piece of white paper with a Wild "Zeichentubus" used on a M20 Wild Research Microscope with 15× eyepieces and a 60× dry achromatic objective with bright field lighting. Looking through the eyepieces a line was drawn joining the posterior edges of the alveoli of the dorsomarginal setae on segments (vi) and (viii) on one side of the pygidium, and the angle made with a similar line drawn on the other side of the pygidium was measured with a protractor to give the "pygidial angle" (fig. 7).

Figs. 5, 8, and 9 give some indication of how the pygidial angle varies with the total number of dorsopygidial macroducts; it will be seen that the variation is almost continuous. In fig. 5A the specimens on *Gleditsia* from the three localities are separable on the average number of ducts, but in fig. 5B there seems to be such a scattering in the material from pear, which also covers the range indicated in fig. 5A, that the writer feels justified in accepting the variation in these two characters as indicated in these graphs as normal for true *africanus*.

In figs. 8A and 8B the variation in these characters from various host plants and localities is shown. The points here also roughly fall into the distribution pattern indicated in fig. 5 and these specimens have also been identified as *africanus*.

In fig. 9A, however, the pattern changes somewhat. Here the specimens from *Acacia*, from longitudinally widely separated areas but latitudinally not more than one degree distant, do not seem to have less than 40 macroducts on the pygidium and the pygidial angle seems on the average to be greater. Although the plates of the pygidial fringe may be slightly reduced compared with that normal for *africanus* (compare figs. 4A-N with Balachowsky (1956) fig. 37 which was apparently made from material collected by Brain on 19.ix.1914 from an *Acacia* in Muckleneuk, Pretoria), the *Acacia* material seems to be conspecific with it.

The material represented in fig. 9B is easily separable from true *africanus* by the great reduction of the pygidial plates (cf. fig. 4O & fig. 6 with figs. 2, 3 and 4A-N).

It is to this material that Marlatt must have referred when he said the plates were minute. The problem which presents itself, however, is to decide which species this material belongs to.

In 1962 Williams described *Diaspidiotus pituranthi* from *Pituranthos* (Umbelliferae) from two lots collected in the Kalahari Gemsbok National Park. Fourteen paratypes of this species have been examined. In these specimens the total number of dorso-

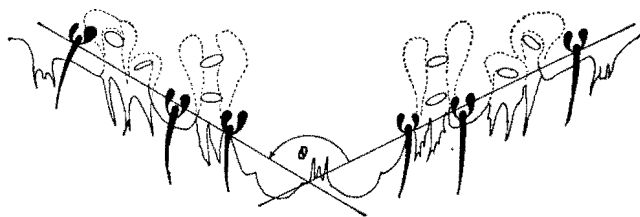


Fig. 7. Method of measuring pygidial angle.

pygidial macroducts varies from 76 to 98. According to Williams there are "about three ducts between the furrow of the first pair of paraphyses and one or two anterior to these on the seventh segment". The total number of ducts on segment (vii) varies from two to six, two occurring only in two specimens but only on one side of the pygidium, and they usually number four or five. Of the fifty specimens represented in fig. 9B five had three macroducts in this position, but only on one side of the pygidium, all the others having but two; the total number of dorsopygidial macroducts varies from 43 to 84. These specimens can therefore be separated from *pituranthi*, though possibly only infraspecifically, by the number of ducts in the first poriferous furrow.

However, material is at hand from two widely separated localities in Pretoria from *Lopholaena corriifolia* (Compositae) (H.C. 1267 and 3783), which bridges the gap between *pituranthi* and the material represented in fig. 9B as far as the number of ducts is concerned. The total number of dorsopygidial macroducts varies from 78 to 100, while there are 2-4 on segment (vii) in the first poriferous furrow. In these specimens the plates are much smaller than in *pituranthi*.

In view of the fact that the *Lopholaena* material and that represented in fig. 9B does not agree, as far as the size of the plates is concerned, with *africanus* and seems to resemble *pituranthi* more, it has been tentatively identified as "*pituranthi* group".

SYNONYMY. *Aspidiotus mashonae* Hall was described from Mazoe, Rhodesia, from *Combretum* and an unknown host plant, and was stated by Hall to be very similar to *Aspidiotus* (*Diaspidiotus*) *mazoeensis* Hall, also described from Mazoe from an unknown host plant. A single slide of *mashonae* bearing the following information was available for study "*Aspidiotus mashonae* Hall, *Combretum* sp., Mazoe, 26.i.28, W. J. H. Cotype (4), 12.iii.29, W. J. Hall". This contained four specimens, three of which were misidentified by Hall and are in fact *Hemiberlesia lataniae* (Signoret), the other being *mashonae*. The material from *C. erythrophyllum* from Pretoria agrees well with the specimen of *mashonae* except that the dorsopygidial macroducts number 45-58 while *mashonae* has 38, and the mesal paraphyses of the first poriferous furrow are slightly less swollen.

Balachowsky (1956) placed Hall's species in a new genus *Diclavaspis*, because of the presence of the second lobes. However, the writer found that when crawlers of *D. africanus* from *Gleditsia* from Vereeniging were placed on *Citrullus vulgaris* at room temperature second lobes developed and were quite conspicuous. In fig. 3A the pygidium of an adult female from *Gleditsia* is shown, and in fig. 3B the pygidium of a specimen from *Citrullus*. This was also confirmed in crawlers from *Ehretia* material from Halfway House transferred to *Citrullus*. It will be noticed too that the dorsopygidial macroducts and perivulvar pores are more numerous in *Citrullus* material. In the six slides mounted from the parent Vereeniging stock the ducts numbered 31-42 whereas the three specimens from *Citrullus* had 46-49. The degree of development of the third lobes as figured by Balachowsky was not observed in any of the material available to the writer.

The only characters which might possibly have justified the separation of *mashonae* from *africanus* at the specific level was the degree of development of the second lobes, but in view of the fact that in this particular case this is apparently host-induced, *mashonae* is considered a junior synonym of *africanus*.

Type material of *Aspidiotus* (*Diaspidiotus*) *mazoeensis* Hall has been available for study from the Department of Agriculture, Salisbury, and is here also considered conspecific with *africanus*. Hall (1929) and Balachowsky (1956) figured and stated that there are only two plates between the obsolete second and third lobes but an examination of several cotypes showed that there are in fact three (fig. 4M). Hall also said

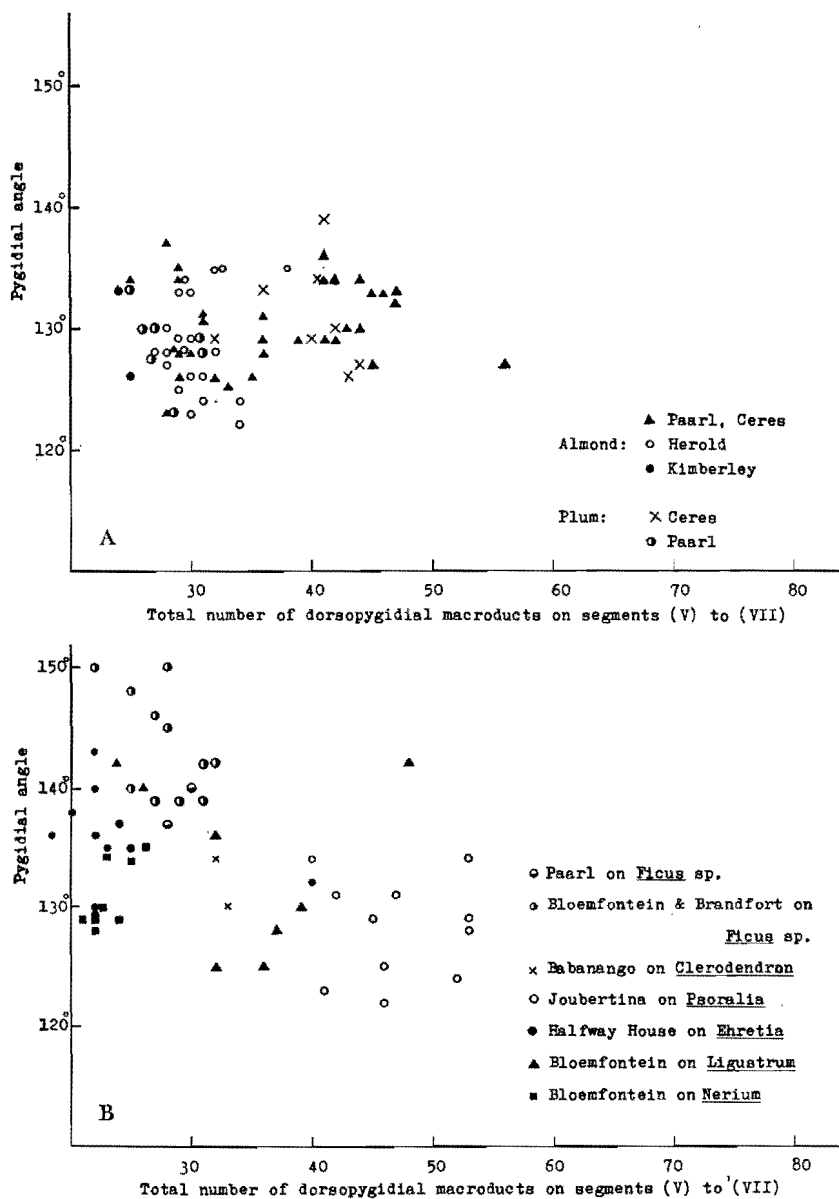


Fig. 8. *Diaspidiotus africanus* Marlatt. Variation of the pygidial angle with the number of dorsopygidial macroducts in specimens from A, almond and plum, B, various host plants and localities as indicated.

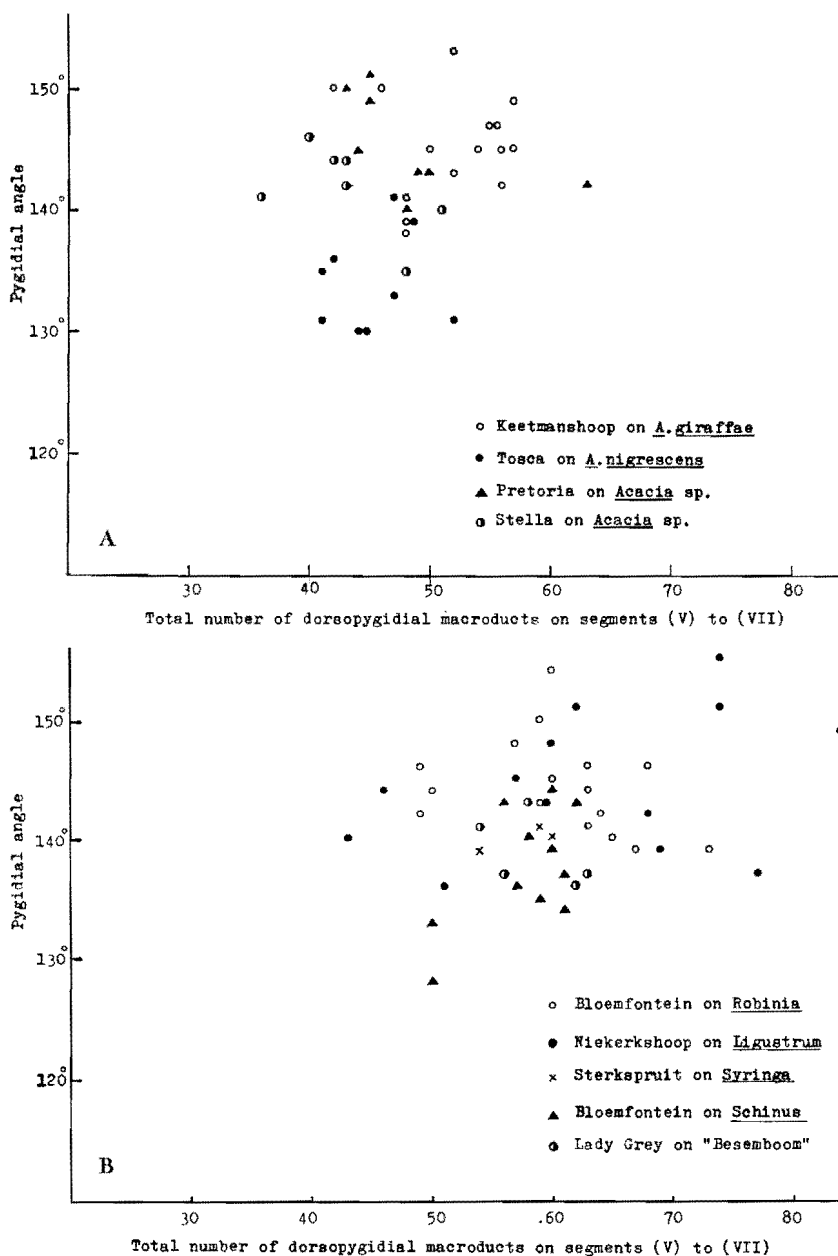


Fig. 9. A. *Diaspidiotus africanus* Marlatt. Variation of the pygidial angle with the number of dorsopygidial macroducts in specimens from *Acacia* spp. from various localities. B. *Diaspidiotus* "pituranthi group". Variation of the pygidial angle with the number of dorsopygidial macroducts in specimens from various localities and host plants as indicated.

"It is also near *Diaspidiotus pectinatus*, Lind., from which it differs in the nature of the lateral squamae and in the conspicuously different sizes of the thickenings on either edge of the 1st lateral incision". Figs. 4M & N show that these characters do not justify specific separation.

Balachowsky separated the two species by the presence or absence of spiniform plates on the margin of segment (vi) and the presence or absence of plates between the median lobes. The "spinosity" of the plates on segment (vi), however, varies considerably depending also on the degree of maceration by treatment with potash; plates are, furthermore, always present between the median lobes in all the material of *africanus* seen by the present writer.

Unfortunately Balachowsky did not specify exactly which lot from the "type series" he based his description on and it was probably one of the non-typical lots Marlatt had before him when he described *africanus*.

He also separated *mazoeensis* from *africanus* (= *pectinatus*) by the presence in the former and absence in the latter of perivulvar pores, but preliminary breeding experiments seem to indicate that this may be a host-induced character which is certainly very variable in all the other material examined. It is, however, true that in *africanus* from *Gleditsia* they are less numerous than in the material of *mazoeensis* the writer was able to examine.

For these reasons *mazoeensis* is here considered conspecific with *africanus*.

Through the kindness of Dr. Gutierre the writer has been able to examine a paratype of *Clavaspis betrokensis* Mamet. There are clearly two plates present between the median and second lobes in this specimen and since no other character could be found to separate it from *africanus* it must also fall as a junior synonym of Marlatt's species.

RELATIONSHIP. *D. africanus* is remarkably similar to *D. maccombi*, and typical *africanus* differs from it in having only two dorsopygidial macroducts in the first poriferous furrow, in having none, or in eight per cent of the specimens only one macroduct dorsosubmarginally on segment (iv), and in apparently having fewer perivulvar pores. All the material of *africanus* also differed from McKenzie's fig. in having a marginal macroduct adjacent to the outer basal angle of the second lobes. However, examination of a paratype of *maccombi* revealed that this duct is apparently also present in this species.

The fact that *Gleditsia triacanthos*, the type host plant of *africanus*, is a North American plant would indicate the possibility of the scale's introduction from that country, but the relatively large range of host plants indigenous to southern Africa seems to indicate a species of African origin.

ECONOMIC IMPORTANCE. A note on the economic importance of this insect might not be out of place here. *D. africanus*, or grey scale as it is commonly called, is one of the declared pests in the deciduous fruit-growing areas of the Western Cape and the Langkloof Valley, and every farmer who has this insect on his property is forced by law to control it. Most of the fruit grown in this area is for the export market and has to be declared free of grey and pernicious scale before exportation is permitted.

Although pernicious scale is said to be phytotoxic through toxins secreted into the host-plant (Balachowsky, 1950; Schettters, 1960), thus causing necrosis and eventual death of the whole plant, Mr. P. L. Bredell, Senior Technician at the Plant Quarantine Station at Stellenbosch informed the writer (1969, *in lit.*) that not a single case is known of fruit trees being killed by an infestation of grey scale alone. The writer has seen very heavy infestations of this insect on indigenous bushes and trees but in no case was die-

back seen, which would certainly have been the case if such infestations had been of pernicious scale. In view of the fact that it is impossible to distinguish between these two species of scale with the naked eye it is probable that this is the reason why such strict phytosanitary precautions are also taken against this apparently non-toxic species.

Diaspidiotus ancylus (Putnam), fig. 10

Diaspis ancylus Putnam, 1878, *Trans. Iowa St. hort. Soc.* 12:321

Diaspidiotus ancylus (Putnam); Ferris, 1938:216; McKenzie, 1956:61

Aspidiotus ancylus (Putnam); Stannard, 1965:575

Fully mature female subcircular when mounted, younger specimens pyriform. Prosoma sclerotized at full maturity particularly along the marginal area. Length about 1.2 mm. Prepygidial segments anterior to segment (iii) with numerous short dorsosubmarginal microducts. Antennal tubercles with but a single hair. Prothoracic marginal tubercle present. Pygidium broadly rounded. Median lobes only well developed, with a subapical notch on both mesal and outer margins; second and third lobes rudimentary. Plates well developed between median and second, and second and third lobes, usually spinose beyond third lobes and never elaborately fringed. Dorsopygidial macroducts numerous, totalling 57 to 80 on segments (v) to (vii); one or two present marginally between median lobes, and four to seven in first row between median and second lobes some of which occur well beyond the anterior extremity of the paraphyses. Perivulvar pores numerous, numbering as follows: median 2-15, anterolaterals 8-27, posterolaterals 2-13. Median group of perivulvar pores often placed linearly so as to connect the anterolateral groups. Posterolateral groups usually with six or more ducts. Anal opening towards apex of pygidium.

MATERIAL EXAMINED. SOUTH AFRICA: *Transvaal*: Vereeniging, July 1944, on *Robinia pseudacacia* (Leguminosae), D. Weeber (H.C. 2150).

Notes

In situ the dark form of this species cannot be distinguished from *Diaspidiotus africanus*, but the presence of so many perivulvar pores, as well as the numerous macroducts in the first row between the median and second lobes distinguish the two species. It also resembles *C. pituranthi* in the number and distribution of the dorsopygidial ducts but may be distinguished by the greater development of the plates, and the presence of perivulvar pores. It also bears an extremely close resemblance to *Diaspidiotus maccombi* McKenzie.

The above description and accompanying fig. is based entirely on the Vereeniging material from twigs of *Robinia pseudacacia* in which the second lobes are rudimentary. The reader should consult Stannard (1965) on the polymorphism known to occur in this insect.

According to Dietz & Morrison (1916) *ancylus* is an important pest of maple and other trees in the United States. This is, however, the first and only record of this species from Africa.

Diaspidiotus osborni (Newell & Cockerell), fig. 11

Aspidiotus osborni Newell & Cockerell, in Osborn, 1898, *Proc. Iowa Acad. Sci.* 5:229; Ferris, 1920:51

Diaspidiotus osborni (Newell & Cockerell); Ferris, 1938:224; McKenzie, 1956:63

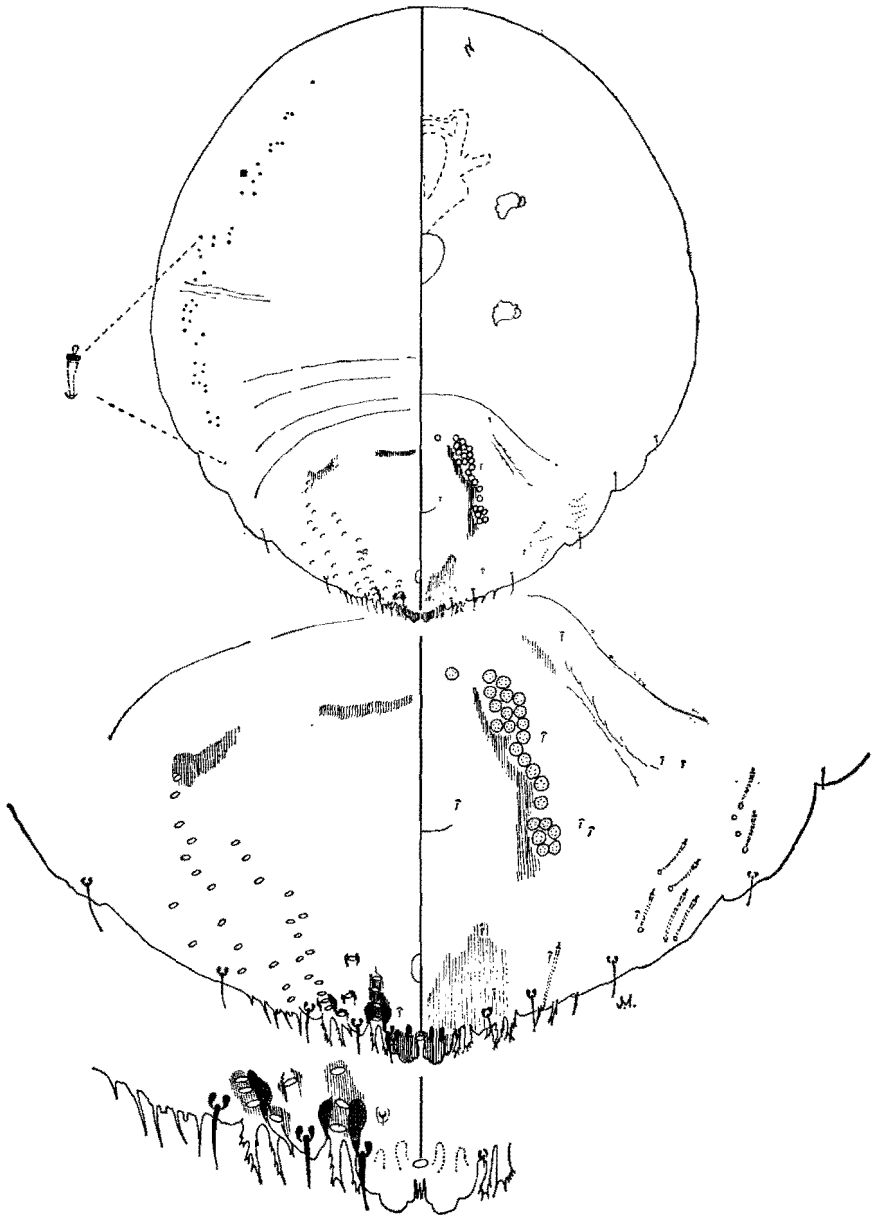


Fig. 10. *Diaspidiotus ancylus* (Putnam).

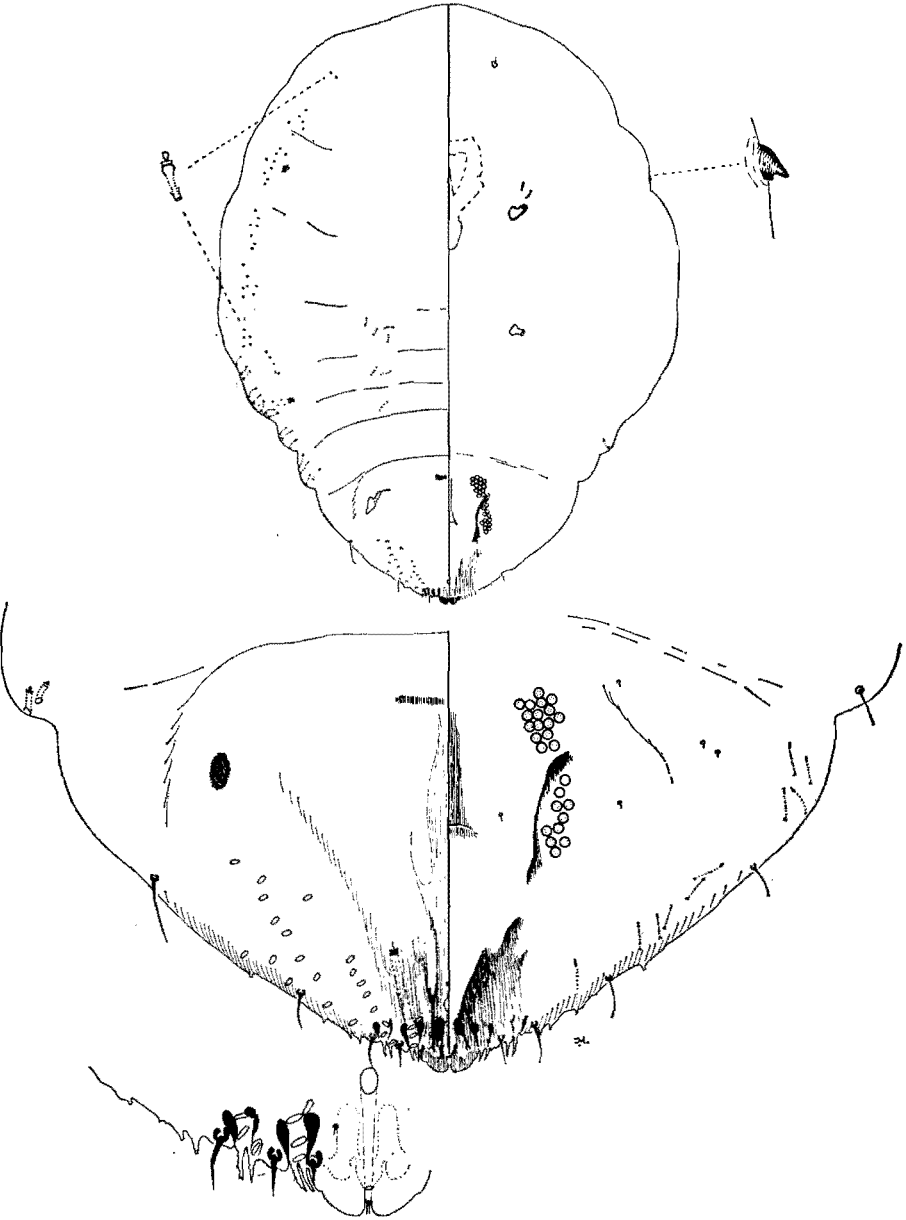


Fig. 11. *Diaspidiotus osborni* (Newell & Cockerell).

Adult female roughly turbinate, about 1.2 mm long when mounted. Prosoma membranous at maturity. Antennal tubercles with a single hair. Marginal thoracic tubercles small but clearly present. Dorsosubmarginal microducts present in a more or less continuous row from cephalic to first abdominal segment; larger marginal ducts present in groups of four or more on each prepygidial abdominal segment. Median lobes with outer margins notched, distinctly longer than mesal margins and diagonal to long axis of the body; second lobes rudimentary; third lobes not discernible. A large sclerosis almost touching the posterior margin of the anus rises from base of median lobes; and a pair of paraphyses bound the first and second poriferous furrows. Dorsomarginal setae on segment (viii) very short, sometimes almost conical, and never projecting beyond notch of median lobes. Two slender plates present between median lobes; two broader plates, irregularly serrate on outer margins between median and second lobes; two or three between second and position of obsolete third lobes, and a platelike structure anterior to the latter. Dorsopygidial macroducts occur as follows: one marginally between median lobes, three to six in first poriferous furrow between median and second lobes, an oblique series of 8–11 in second poriferous furrow, and another more or less parallel row of 7–13 ducts arises marginally between dorsomarginal setae of segments (v) and (vi). Perivulver pores present in four or five groups as follows: median 0–2, anterolaterals 9–20, posterolaterals 5–11. Anal opening small, near apex of pygidium: distance from anterior margin to apex of median lobes 46–50 μ .

MATERIAL EXAMINED. SOUTH AFRICA: *Cape Province*: Stellenbosch, 28.xi.1964, on *Quercus robur* L. (Fagaceae), J. Munting (H.C. 1783).

Notes

Originally described from Iowa, U.S.A., this is apparently the first record of this species from Africa.

Specimens of this species from California were examined and there is no doubt that they are conspecific with the Stellenbosch material. All the specimens both from California and South Africa, however, differ from the description published by Ferris (1938) in that the prosoma is membranous at maturity, there is always a pair of slender plates between the median lobes, and the dorsomarginal setae on segment (viii) are always shorter than those on segment (vii).

Diaspidiotus yomae spec. nov., fig. 12

A small species; scale of adult female hidden in cracks in the bark of host and varying in shape accordingly; about 0.75 mm in diameter.

Adult female roughly turbinate, 0.4 to 0.6 mm in length. Antennae with a single hair; marginal prothoracic tubercle small, lenticulate, sometimes almost absent. Median lobes well developed, almost conical, with a conspicuous, well defined basal sclerosis projecting into pygidium, with a deep preapical notch on mesal and outer margins; mesal margins clearly divergent. Other lobes obsolete. Paraphyses and intersegmental scleroses characteristically shaped as in fig. 12. Plates very small and usually spinose, absent between median lobes, one or two between median and obsolete second lobes as well as between dorsomarginal setae of segments (vii) and (vi). Marginally on segments (v) and (vi) are a number of small truncate tubercles each with a microduct opening through their apices. Dorsopygidial macroducts occur as follows: one

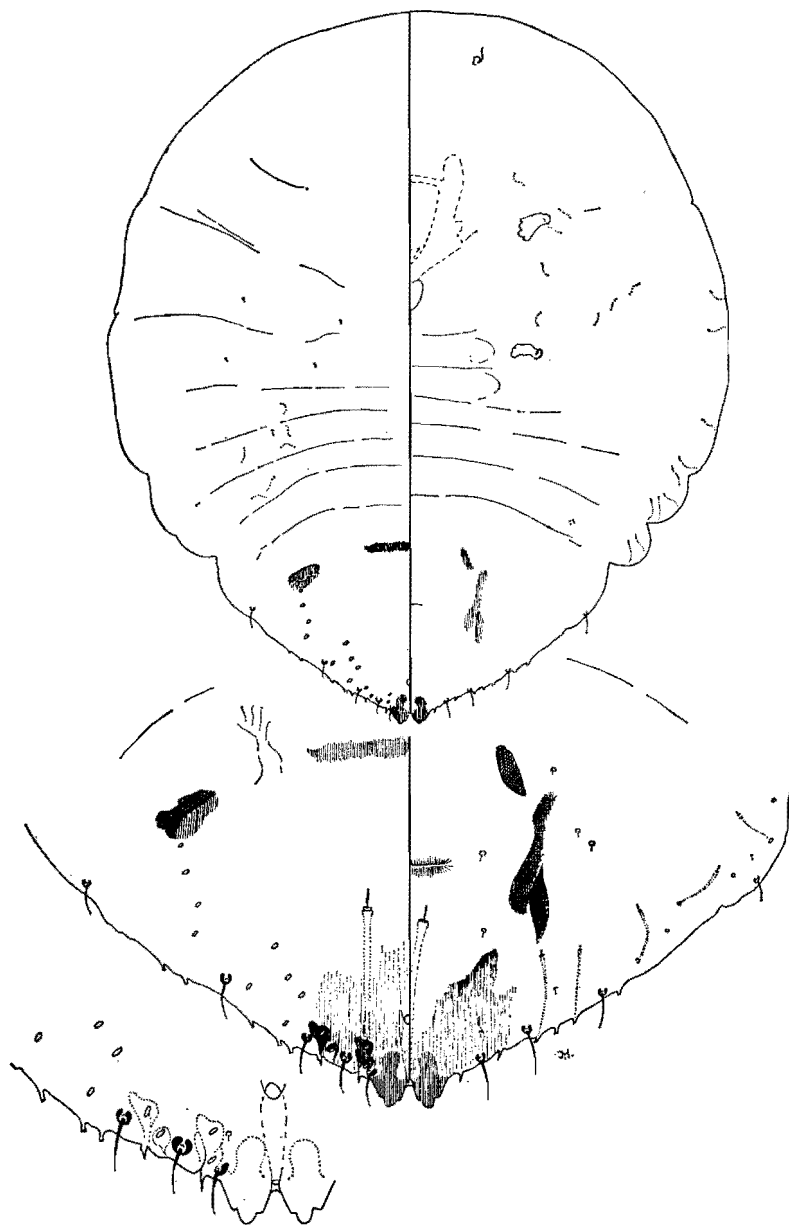


Fig. 12. *Diaspidiotus yomae* spec. nov.

marginally between the median lobes; two enclosed by a sclerotized area between the median and obsolete second lobes; then a row of five or six ducts of which the two submarginal ones have heavily sclerotized orifices; two (occasionally one) ducts submarginally between dorsomarginal setae of segments (v) and (vi); and an irregular row of two to five ducts ascends to the basal apophysis from near the marginal setae of segment (v). Laterobasal pygidial apophysis well developed and conspicuous. Perivulvar pores absent; paravulvar folds well developed, broad posteriorly. Anal opening very small (about 3–5 μ) and situated near apex of pygidium.

MATERIAL EXAMINED. SOUTH AFRICA: *Transvaal*: Christiana, 11.iii.1967 on *Diospyros* sp. (Ebenaceae), J. Munting. Described from young adult females. Holotype (H.C. 2831/1) and seven paratypes.

Notes

This species is remarkably similar to *Diaspidiotus makii* (Kuwana) from Japan, as redescribed by Takagi (1958). It differs from *makii*, however, in having a smaller anal opening, no plates between the median lobes and the mesal margins of the median lobes divergent.

This species is named for my dear wife, Yoma, who so often has to remain at home with the children while I go on collecting trips.

Dynaspidiotus regius (Brain), fig. 13

Aspidiotus regius Brain, 1918, *Bull. ent. Res.* **9**: 121.

Dynaspidiotus regius (Brain); Balachowsky, 1958: 162.

Adult female broadly fusiform when mounted, 0.7 to 1.2 mm long, entirely membranous except for pygidium which is sclerotized. Marginal thoracic tubercle present on prothorax. Parastigmatic pores absent. Median lobes about as broad as long, apically rounded, once notched on both lateral margins, somewhat constricted basally; second lobes like median but slightly smaller; third lobes small, pointed but clearly visible; other lobes obsolete. Two plates between median and two between median and second lobes, apically fimbriate, about equal in length to these lobes; two or three longer and variously fimbriate plates between second and third lobes and three elongate plates with a small microduct orifice near their base beyond the last pair of lobes. Marginal setae as figured: dorsal setae between median and second lobes long, very slender and difficult to see. Dorsal pygidial macroducts relatively short and broad; one marginal duct occurs between median and second lobes and one displaced well forward to this, two marginally between second and third lobes; a fairly regular row of seven or eight ducts arises between marginal setae of segments (v) and (vi), and three or four submarginally on segment (iv). Two or three smaller ducts occur marginally on meso- and metathoracic and first two abdominal segments. Perivulvar pores present in four groups: anterior laterals with three or four pores, posterior laterals with two or three each. Anal opening large, about equal in width to that of median lobes ($\pm 11\mu$), situated at about apical quarter of pygidium.

Lectotype in U.S. National Museum, Washington.

MATERIAL EXAMINED. SOUTH AFRICA: *Cape Province*: Kingwilliamstown, March 1913, on *Aloe* sp. (Liliaceae), A. Kelly (adult female lectotype (C.K.B. No.

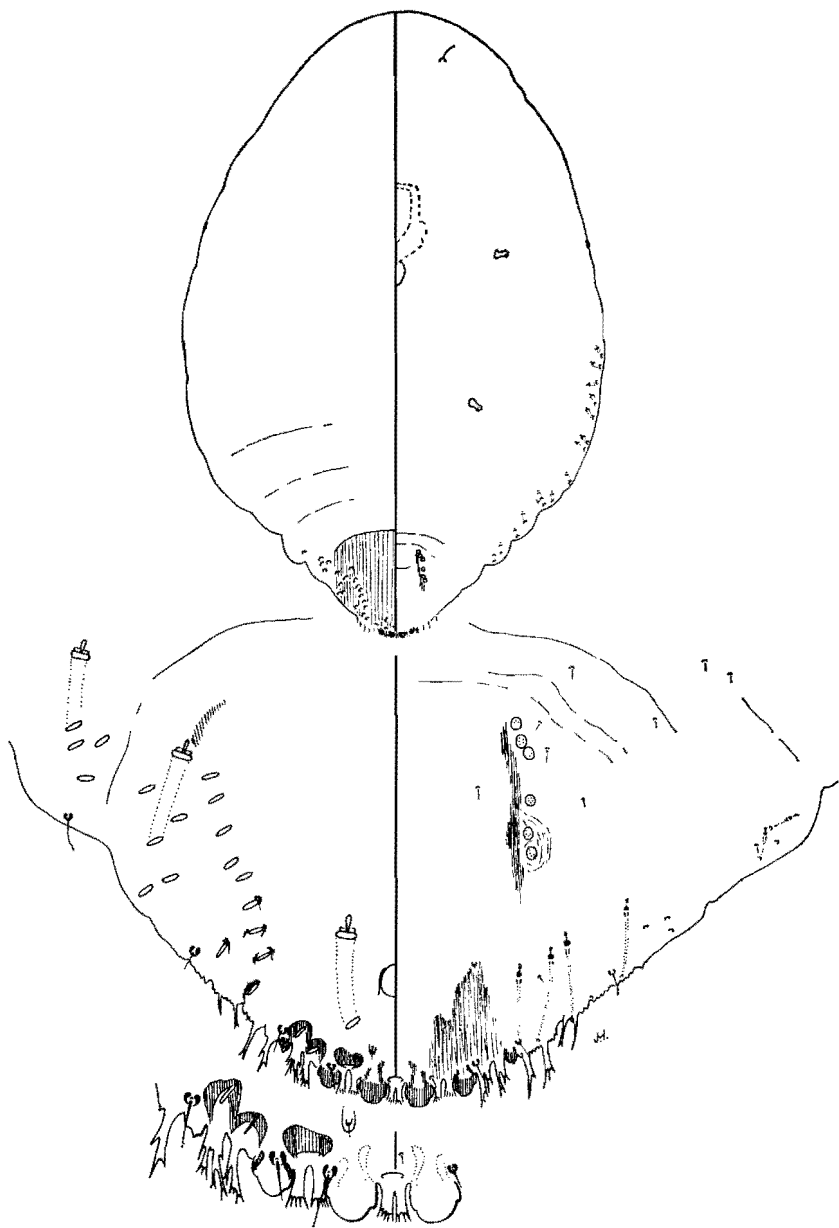


Fig. 13. *Dynaspidiotus regius* (Brain).

B 200/1) and one adult female paralectotype were designated from syntypes in the United States National Museum); Quamata, about 45 miles east of Queenstown, 2.xii.1996, on *Aloe* sp., B. Veenemans (H.C. 3854).

Notes

This species appears to be correctly placed in *Dynaspidotus* though the very broad macroducts seem to be unique.

Quadraspidotus perniciosus (Comstock), fig. 14

Aspidiotus perniciosus Comstock, 1880, *Rep. Ent. U.S. Dep. Agric.* 1880: 304.

Quadraspidotus perniciosus (Comstock); Ferris, 1938: 259; McKenzie, 1956: 81; Balachowsky, 1958: 214.

MATERIAL EXAMINED. RHODESIA: Marandellas, on *Prunus persicus* (Rosaceae) (H.C. 3853); Odzani, on *Prunus persicus* (H.C. 3853) and *P. malus* (H.C. 3851). SOUTH AFRICA: Transvaal: Bronkhorstspuit, on *Prunus persicus* (H.C. 1888, 1980, 1981, 2020, 2242), on *Pyrus communis* (H.C. 1989), on *Prunus communis* (H.C. 2038); Florida, on *Fraxinus* sp. (Oleaceae) (H.C. 1904); Lochiel, on undet. host (H.C. 1861); Muldersdrif, on *Prunus persicus* (H.C. 3254); Pretoria, on *Quercus* sp. (Fagaceae) (H.C. 398), on *Pyrus communis* (H.C. 1890), on *Prunus persicus* (H.C. 1591, 1798, 2039), on *Camellia* sp. (Ternstroemiaceae) (H.C. 1910), on *Cotoneaster microphylla* (Rosaceae) (H.C. 2034), on *Pyrus malus* (H.C. 2035, 2167), on *Chaenomeles lagenaria* var. *moorloosei*

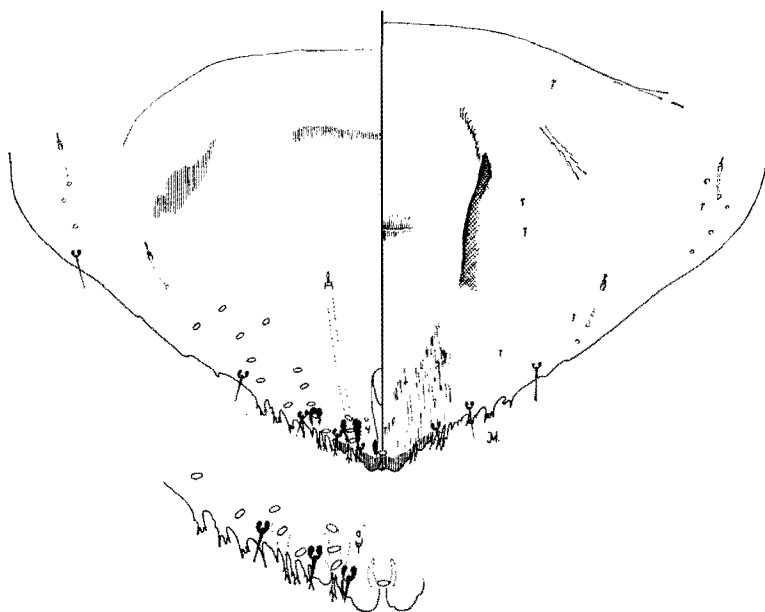


Fig. 14. Pygidium of *Quadraspidotus perniciosus* (Comstock).

(Rosaceae) (H.C. 2036); Rustenburg, on *Pyrus communis* (H.C. 1435). *Cape Province*: Belvedere, on *Prunus persicus* (H.C. 3124); Cape Town, on *Prunus persicus* (H.C. 529, 2103); Ceres, on *Pyrus communis* (H.C. 2059); Franschhoek, on *Prunus persicus* (H.C. 1739) and *P. domesticus* (H.C. 2164); Graaff-Reinet, on undet. host (H.C. 1137); Joubertina, on *Pyrus malus* (H.C. 527, 2217), on *Prunus cerasus* (H.C. 2212), on *P. domesticus* (H.C. 2219), on *Pyrus communis* (H.C. 2220), on *Prunus persicus* (H.C. 2383). *Natal*: Greytown, on *Populus* sp. (Salicaceae) (H.C. 3784); Richmond, on *Prunus domesticus* (H.C. 507); Winterton, on undet. host (H.C. 2104). *Orange Free State*: Bethal, on undet. host (H.C. 2140); Bloemfontein, on *Cydonia oblonga* (Rosaceae) (H.C. 2384), on *Pyrus malus* (H.C. 2748), on *Pyrus communis* (H.C. 2749); Clocolan, on *Cydonia oblonga* (H.C. 2308); Ficksburg, on *Prunus persicus* (H.C. 2183), on *Pyrus malus* (H.C. 2705), on *Chaenomeles* sp. (H.C. 2744), on *Prunus* sp. (H.C. 2582); Fouriesburg, on *Rosa* sp. (Rosaceae) (H.C. 2037), on *Gleditsia triacanthos* (Leguminosae) (H.C. 2650); Golden Gate Highlands National Park, on *Prunus persicus* (H.C. 2584), on *Chaenomeles japonica* (H.C. 2585), on *Pyracantha rogersii* (H.C. 2146); Ladybrand, on *Pyrus malus* (H.C. 2587), on *Pyrus communis* (H.C. 2583), on *Cydonia oblonga* (H.C. 2747); Tweespruit, on *Ribes* sp. (Grossulariaceae) (H.C. 1720); Senekal, on *Prunus persicus* (H.C. 1931); Warden, on *Pyrus malus* (H.C. 2306), on *Cydonia oblonga* (H.C. 2307); Winburg, on *Cydonia oblonga* (H.C. 2321); Wolwehoek, on *Pyrus malus* (H.C. 2249).

Notes

This species is very similar to *D. africanus* but may readily be distinguished from it by the total absence of perivulvar pores, the fact that there are normally three macroducts in the first poriferous furrow, and the shape and degree of development of the second lobes. Though, as already indicated, the second lobes may be well developed in *africanus* they are always hyaline and never thick and yellow as is normal for *pernicius*.

Takagi (1969) suggested that *Comstockaspis* MacGillivray, 1921, which was erected with *pernicius* as the type species, might possibly be a valid genus. This is based (Takagi, 1966 *in litt.*) on the degree of development of the paraphyses and the plates between the dorsomarginal setae of segments (v) and (vi). Though the writer would at this stage not like to comment on the validity of the first-named character, the variation indicated in fig. 4 seems to preclude the latter as a valid generic character.

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